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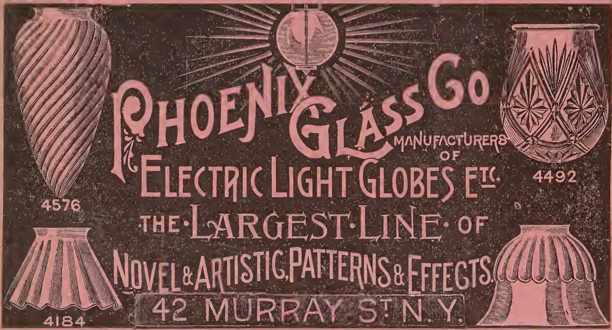

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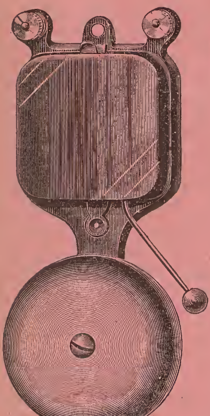

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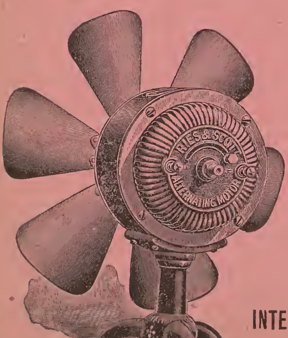

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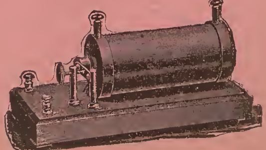

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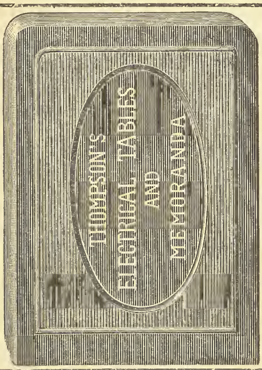

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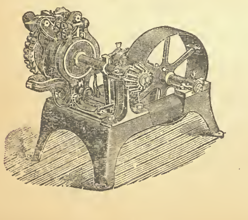

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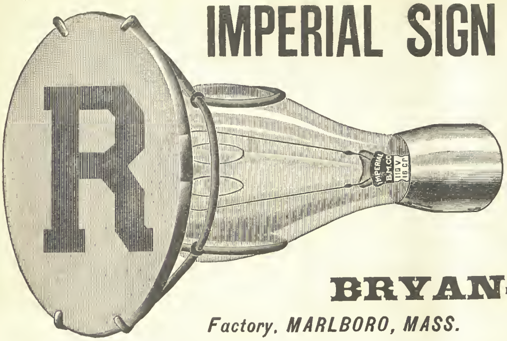

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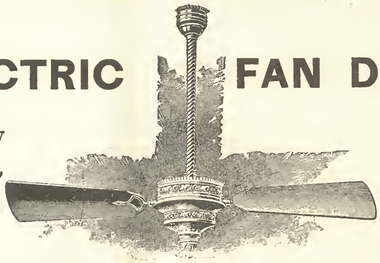

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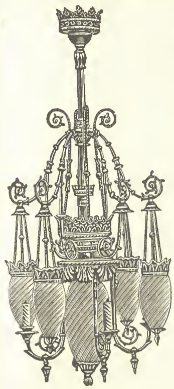

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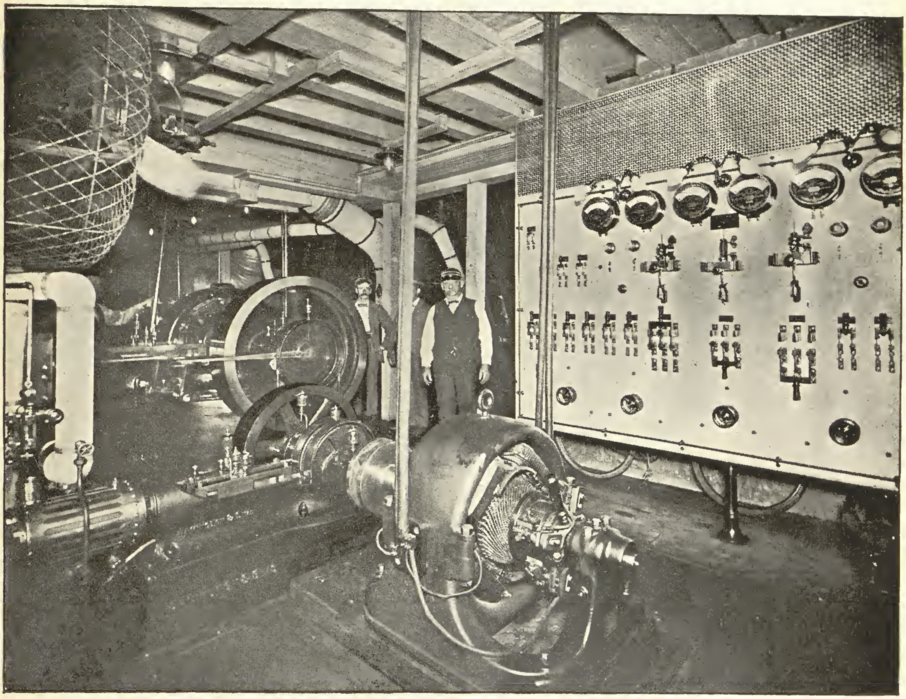


PLANT ON BOARD THE STEAMSHIP ADIRONDACK.

A MODEL STEAMBOAT PLANT.

The People's line, some weeks ago, placed into service a new steamer, the Adirondack, and had it equipped with a first-class electric light plant.

Mr. J. P. Hall, of No. 143 Liberty street, was the electrical contractor, under whose experienced care the wiring was properly installed. The electric light plant, set up under the supervision of Mr. S. E. Drake, is, without doubt, one of the finest ever placed on board a vessel of this kind. It seems that, besides ocean greyhounds, the smaller craft are coming to the conclusion that a closer attention to the comfort of their passengers will insure a greater and more profitable popularity. The People's line are wide-awake on this subject, and in the equipment of the Adirondack have demonstrated their views in a most practical manner.

A marine boiler feeds the engines with a pressure of 40 pounds. Before reaching the engine it passes through a Stratton separator and is thus dried. The engines are Armington and Sims', two in number, sold by E. P. Hampson, No. 36 Cortlandt street, driving, separately, a pair of 800-light Westinghouse generators. The whole runs noiselessely and without perceptible vibration. Mr. Robt. Keasby, of No. 54 Warren street, supplied the magnesia sectional covering used on the steam piping. The engine room is refreshingiy cool. At one corner, a large pressure blower fills the room with pure air; at the other is an equally vigorous fan absorbing it rapidly, and thus creating between the two a strong current. A pair of Worthington pumps are busy supplying water to the boiler and help to complete this scene of engineering completeness. The engines are in communication with a Worthington jet condenser connecting with the exhaust, the water from which passes overboard. The generators each have a pair of Weston station instruments, and a powerful search light is likewiseequipped. The dynamos are self-regulating, connected in parallel, and feed twenty-

five circuits. A smaller generator, in addition to the two larger ones, of 10-kilowatt capacity, is direct-connected, like the rest, to a 15-horse power Armington & Sims. The wiring is brass armored, conduit and circular loom. In many parts lead-covered cable is used All the wire is of uniform grade and comes from the Habishaw factory. Carpenter enamel rheostats add a little to the regulating devices of the dynamos, and another rheostat places the search light under direct control. A Russell See indicator gives immediate notice if either of the electric side lights fail. The elegant switchboard of white marble is provided with switches controlling the main circuits on the saloon deck, gallery, etc. The entire vessel is remarkably well wired. Beautiful chandeliers, ceiling lights and pillar fixtures ornament the interior. It is a pleasure to look upon such work, in which evidently no expense has been spared to make it an unparalleled success.

ALTERNATING CURRENT APPARATUS.

BY C. KAMMEYER.

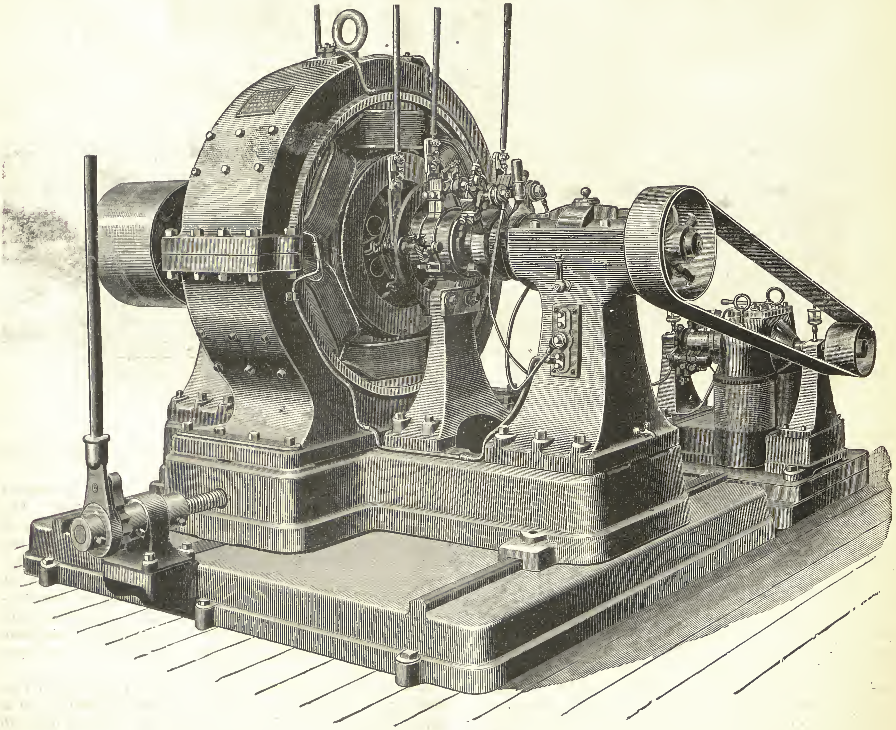
(World's Fair Electrical Engineering.)

Among the various electrical machines now in use for the production of light, heat or power, the alternating current dynamo with its accessories, such as transformers, etc., occupies a prominent position. It goes without saying, that in the operation of alternating current machines, as well as direct current apparatus, the best results can only be obtained where the machinery is handled by men thoroughly familiar with the construction and working of the machinery under their control. Too often, however, the apparatus is shipped and set up by the maker, and started by one of his so-called "experts," who, after a few hasty and generally rather indefinite instructions, takes his departure, leaving the bewildered engineer or dynamo tender to "wrestle" with the "new-fangled" machines as well as he may. As long as everything operates under normal conditions all is well, but very often, should anything unusual occur, the attendant in charge is more or less at sea.

Nearly all, if not all, modern alternators, such as the Westinghouse, Thomson-Houston, National, etc., are built after the same general design, and consist of a multi-polar field magnet of from eight to fourteen or more poles, in which the armature revolves. In one or two systems this arrangement is reversed, i. e., the armature is stationary and the field revolves.

The field magnets are, as a rule, "excited" or magnetized by means of a small direct-current dynamo, called the exciter. This exciter may be a separate machine driven from a countershaft, or from a pulley on the alternator shaft, but is often combined with the alternator by mounting the exciter armature on an extension of the main shaft. Such machines are sometimes, although erroneously, called self-exciting.

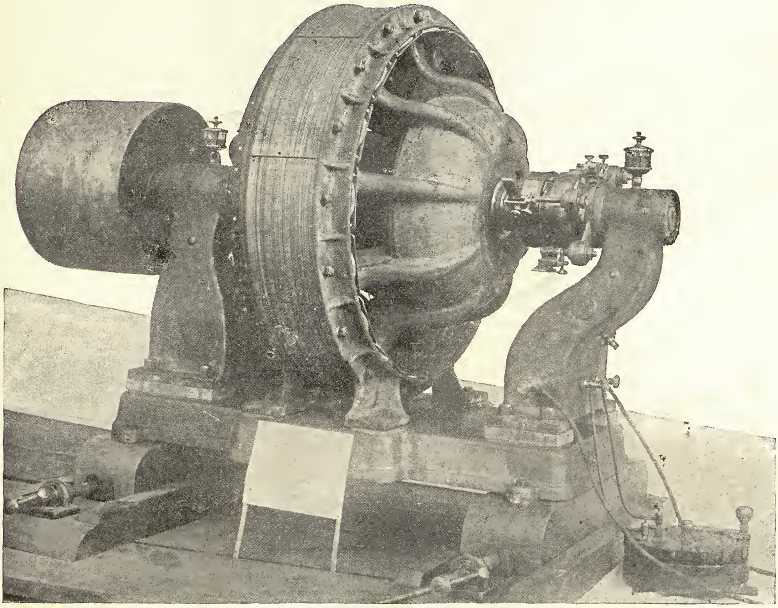
In one well-known system the exciter armature coils are wound parallel with and on the same core as the alternator coils, the current being collected by means of a special commutator, but even such an arrangement cannot be properly called self-exciting. Another arrangement consists in connecting the terminals of one of the main armature coils to a special two-part commutator, so



TYPICAL ALTERNATOR.

as to transform the alternating impulses into a continuous current, suitable for exciting the fields. The field magnets with their exciter being entirely separate and distinct from the main or alternating current, it follows that any trouble or disturbance of the main circuit can only be due to causes existing on the circuit or armature, and need never be looked for in the field magnet coils or the exciter.

The armature, until recently, was usually of the drum type, with a number of coils corresponding to the number of field magnets wound or laid on the surface of the core, and held in position by means of binding wires of steel or some other suitable material. In some of the latest forms, however, the core is of the Pacinotti type, and has as many teeth or projections as there are field cores. The armature coils are wound on separate forms of paper, abestos or the like, and slipped over the armature teeth, where they are held in position by means of wooden wedges or some other suitable device. This arrangement is quite an improvement over the older type of armature, as it enables us to readily exchange or repair an injured coil without the necessity of removing any bands or binding wires. It also enables us to better insulate the coils, which is of great importance in machines of high voltage.



ALTERNATOR WITHOUT EXCITER.

The armature coils, being wound alternately right and left-handed, are either connected in series or joined in multiple, according to the voltage and carrying capacity desired, the terminals in either case being led to a pair of collector rings. Some makers arrange the armature connections so that they can be readily changed from series to multiple, and vice versa. An armature giving a current of say 1,000 volts and 50 ampères can thus be easily changed so as to deliver a 25-ampère current at a pressure of 2,000 volts.

The armature with its coils revolving past the magnetized field cores produces a current of rapidly changing polarity. The number of alternations depends upon the number of field magnets or armature coils and the speed of the machine. A ten-pole machine, for instance, running at a speed of 1,500 revolutions per minute would give 15,000 alternations, or 250 per second.

The voltage, pressure or electromotive force of an alternator depends upon three things—the speed, number of armature conductors, and intensity of the magnetism of the field cores. Varying either of these factors will therefore produce a corresponding change in the electromotive force or voltage of the dynamo. Given an alternator running at a constant speed, a most convenient way of changing or regulating its voltage consists in varying the exciting current. This can be done by putting resistance either in the exciter or alternator fields, the effect being the same in either case. From this we deduce another fundamental principle—any change in the exciting current will cause a corresponding change in the armature current.

In the operation of dynamos and other electrical machinery, constant vigilance is the price of safety. Do not assume that because a machine ran successfully last night, it will do so again to-day. Before starting, see that the dynamo, exciter and all their parts are scrupulously clean, free from all dirt, grease or accumulation of copper or carbon dust. Carefully examine all binding-posts, connections or screws, and make sure that they are clean and tight. The constant vibration of a machine will sooner or later loosen screws or connectors, and very often an open circuit is the result.

See that the oil cups are filled with a good quality of lubricating oil and adjust them to feed properly. In a new machine supply the oil rather freely at first, until all bearings are running smoothly and cool.

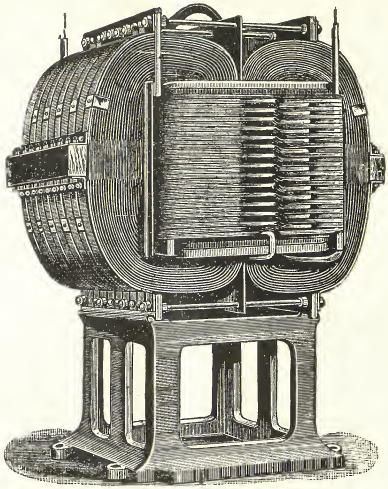
The circuit or circuits should also be examined daily for grounds or escapes. Do not depend upon the behavior of a cheap magneto bell for this, but use a bell that will ring through at least 50,000 ohms; or better

still, procure a suitable resistance set and measure the insulation resistance between line and ground daily. It will be found advisable to keep a record of these daily tests for future reference.

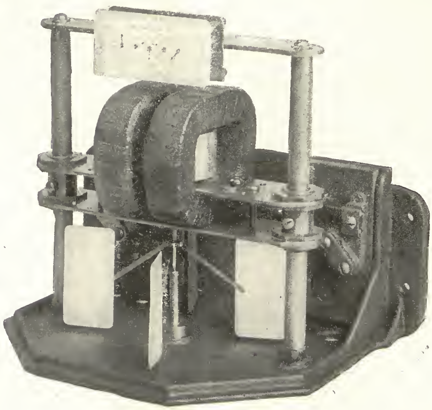
Before starting the machine it will be necessary to properly set the brushes. Specific directions on this point may vary with different systems, but the following general remarks are applicable to all kinds of machines.

The alternator brushes should be set so as to bear on the collector rings with a moderate pressure. The exact position or angle of contact on the rings is immaterial, as the brushes merely serve to collect or take off the current from the rings. To avoid cutting of the rings a very small quantity of oil should occasionally be applied by means of a small linen pad secured to the end of a stick. Do not use your finger for this, while the machine is generating current, as it would be needlessly exposing yourself to danger.

In the setting of the exciter brushes more care and precision are required. Always set the brushes so as to make contact with diametrically opposite segments of the commutator. Most makers mark two opposite sections with a dash or arrow. If they are not so marked, cut a strip of paper or tin and measure around the commutator; one-half of this distance will give the desired points. Before placing brushes on commutator, their ends must be given a proper bevel by filing or grinding. This bevel should be such as to cover not more than one commutator segment when all copper brushes are used. Carbon brushes or brushes having their outer layers or leaves composed of high resistance material (such as the "Wirt" brush) may be allowed to cover more than one section. The more sections thus covered, the hotter the armature will become, because more of the armature coils are short-circuited by the brushes, when passing the natural point. See that the bevel of the brushes runs parallel with the commutator bars, so that the brush bears evenly on same and not merely on one corner or edge. It is of course of



LARGE STATION TRANSFORMER.



POWER MEASURING METER.

the utmost importance that the commutator itself be at all times kept perfectly round, true and smooth. This can only be accomplished by keeping the brushes from sparking at all times and adjusting their tension or pressure so that they will not cut or score the commutator. A very little vaseline should occasionally be applied with the tip of the finger to prevent excessive friction. Should any cutting or scoring take place, the defective spot should be immediately smoothed and polished by holding a pad of fine sandpaper against the commutator, while the latter is in motion. Never under any circumstances use emery on a commutator, as the particles of emery are apt to embed themselves in the soft copper and remain there.

One of the most prolific and annoying troubles met with in alternators is sparking of the exciter brushes. This may be due to several causes. In the first place, the brushes may not be set at the neutral or non-sparking point. This should be remedied by carefully shifting the position of the brushes by means of moving the rocker-arm, until the sparking is reduced to a minimum. If the brushes are set so as to touch exactly opposite points on the commutator, and the latter is round and smooth, no perceptible sparking will occur in a properly designed machine. If, however, the commutator is rough or out of round, or both, it will be impossible to prevent more or less sparking. In this case the commutator must be carefully trued up by means of a file and then polished with fine sandpaper. Wherever it is possible, the trueing up of commutators should be done in a lathe, as it is extremely difficult to get the commutator exactly round by filing it.

If the brushes make poor contact with the commutator, or the latter is covered with dirt or grease, sparking will invariably occur. Where any lubricant is used on the commutator, a very minute quantity will generally be found sufficient, and even this, with any dust or copper dust which may have accumulated, should occasionally be removed by means of a linen rag moistened with benzine, being very careful to not apply this when any current is on, as a spark may ignite the benzine.

Sparking may also be due to the exciter being overloaded, although this is of rare occurrence, and can only be caused by one or more of the alternator fields being short-circuited. This, of course, would prevent the proper working of the alternator itself.

It occasionally happens that an alternator fails to start or generate, when all the connections, etc., are apparently in good working order. The trouble will generally be found in the exciter or its connections. By carefully holding a piece of iron near any one of the alternator fields while the dynamo is running and all connections properly made, we can readily determine whether or not the fields are being magnetized. If no magnetism can be detected, the trouble is in the exciter. See if the exciter fields are being magnetized; if so, the circuit of the alternator fields is open. This nearly always occurs at the terminals of the field coils; if these terminals are connected by means of couplings, these may have become loose from constant vibration, or the ends of the wire may even be broken off short where they leave the coil. Careful examination will generally disclose the faulty place.

(To be continued.)

The Pittsburg "Daily News" says: "The new electric motor at the Westinghouse works, at East Pittsburg, is nearly ready for the final tests. It is expected that Geo. J. Gould, and probably Russell Sage, will be present. If the motor shows the wonderful powers attributed to it by Nikola Tesla, the inventor, there is little doubt that the trial will be wonderfully successful, and its adoption as the motive power for the L roads of New York almost assured. Other motors have been experimented with by the officials of these roads, but none have given the satisfactory results predicted for that of Tesla. It is on the polyphase alternating-current system."

ROENTGEN RAYS.

No Oxygen Salts

Iridium, like the other platinum metals, shows but little tendency to form oxygen salts. The oxides dissolve in acids, but no definite salts are obtained in this way.

The Birthplace of Volta.

Como is the birthplace of Volta, and will celebrate in 1899 the 100th anniversary of his invention of the voltaic battery by an electrical exhibition and congress.—Science.

Tidal Waves in the Pacific.

The Eastern papers quote from the Oregon "Gazette" a description of a tidal wave which has been seen at Victoria and along the North Pacific coast, doubtless caused by the recent Japanese earthquake. On June 15, the residents at the mouth of Rogue River witnessed a series of tidal waves. The fishermen, out in the river with their boats, noticed soon after noon a series of waves coming into the river, increasing the volume of water considerably. The waves continued to grow in size until they became dangerous, and boatmen had to watch carefully to keep from being swamped. Between 2 and 3 o'clock the waves were from three to six feet high. The inrushing volume of water made itself felt for over a mile up the river, beating against the banks in waves several feet high, while the water of the river was backed up for several miles. The disturbance lasted all the afternoon, being at its height from 2 to 3 o'clock, gradually diminishing until the waves disappeared about 6 o'clock. During the afternoon the bar and sea were smooth, with a light swell running. A number of the largest waves in the river were timed, and it was found that they came about a mile apart and traveled the mile in about three minutes. A correspondent of the Washington "Star" writes from Honolulu that the western coast of the island of Hawaii was visited by tidal waves of destructive force from 7 a. m. to 2 p. m. on June 15. At Keanhou the water reached points 35 feet above the sea. The shocks of the earthquake were, it appears, registered by instruments in Italy.—Science.

Temperature of Flames.

Professor Hartley has lately been studying the temperature attained by various flames. The means by which he arrived at the temperatures were test wires of such tenuity that the mass of metal was insufficient to cool the flame, this principle being that which was enunciated by Faraday some years ago. Faraday showed at that time, that a very thin platinum wire could be fused by only a candle flame, and that in such cases the carbon of the flame does not lower the melting point of the platinum. This latter statement has been again demonstrated by Professor Hartley, who has also discovered, by means of spectroscopic observation, that the temperature is as high as the melting point of platinum.—London Electricity.

The Problem of the Sun's Temperature

Has been atacked in a variety of ingenious ways. Rosetti has recorded a temperature up to 10,000° C., using a thermopile; Le Chatelier, 7,600° C., by comparing the absorption of solar rays with that from a hot object; Wilson and Gray, 6,200° C., by balancing, in a Boys' radiomicrometer, the radiation from the sun against that from a glowing strip of platinum; Scheiner, between 4,000° and 10,000°, by measuring the breadth of the magnesium lines in the spectrum. Professor Paschen, the latest observer, considers the wave-length of maximum energy in sunlight as inversely proportionate to the absolute temperature of an incandescent body, and gets 5,130° C.—London Electricity.

STANDARDS OF LIGHT.

(Continued from Page 423.)

By this means the efficiency of the bolometer was nearly doubled. The tinned surface did not tarnish perceptibly during the course of the investigation. It was not smooth enough to reflect a distinct image, and the light reflected from it was to a large extent scattered. The use of a plane-surfaced mirror in such a position would not be allowable, since any slight amount of light in the angle of incidence would cause a different amount of light to be reflected upon the bolometer strip. The use of the irregular-surfaced plate, since it diffuses the light, can scarcely affect the accuracy of the results to an appreciable degree in such work as has been done with this bolometer. Nevertheless, this arrangement is to be recommended only where great sensitiveness is desired rather than the most exact comparison of results.

The galvanometer employed was of the four-coil type. It was constructed by Prof. W. S. Franklin, after the same general plan as has been followed by Snow,[1] Paschen,[2] and others. When the two front coils were in multiple with each other and the two rear coils similarly connected, and the two pairs were connected in series, the resistance was found to be 190 ohms. The moving parts consisted of four little magnets of piano wire, each about 5 mm. long, and a mirror of thin cover glass, 4 mm. wide by 7 mm. long, all mounted on a slender rod of glass and suspended by a very fine quartz fiber. Any oscillations of the needles were very strongly and effectively damped by the air resistance to the light-moving parts—a very essential condition to the correct operation of the instrument when used to get the variations of a rapidly fluctuating source of radiant energy.

The scale was divided into 100 half-inch divisions, each of which was, in turn, divided into tenths. The distance of the scale from the galvanometer was 100 scale divisions, *i. e.*, 50 inches. With the telescope used, fifths of the smallest divisions could be estimated. In speaking of scale divisions, the half-inch divisions will always be meant.

To test the sensitiveness of the apparatus, the galvanometer was adjusted until the period of the needles was six seconds for a complete vibration. A deflection of one scale division corresponded to a current of 68×10^{-10} amperes.

This deflection of one scale-division corresponded to a temperature rise in the bolometer strips of 0°.00657 C. It we reduce this to millimeter divisions on a scale placed at a distance of one m. from the mirror, we see that one millimeter deflection corresponded to a current of 68×10^{-11} amperes, and the corresponding rise in temperature of the strip was 0°.00066 C.

This temperature sensitiveness is much smaller than has usually been employed in bolometer work, but it was amply sufficient for the purpose. That the bolometer itself was one of high sensitiveness is evident from the fact that this degree of sensitiveness was attained with galvanometer needles swinging in a strengthened field and with a galvanometer of 190 ohms resistance. The conditions for maximum sensitiveness of the bridge would have required a galvanometer resistance of only 0.5 ohm.

The reason for the great sensitiveness lay in the nature of the strips employed. Their area was considerable, the temperature coefficient of the iron was high, and the current through it was large, ranging from 0.15 to 0.20 ampere, the size of the strips permitting the use of a large current without undue heating. As a result of the strong field in which the galvanometer needles swung, the drift due to magnetic changes was usually imperceptible.

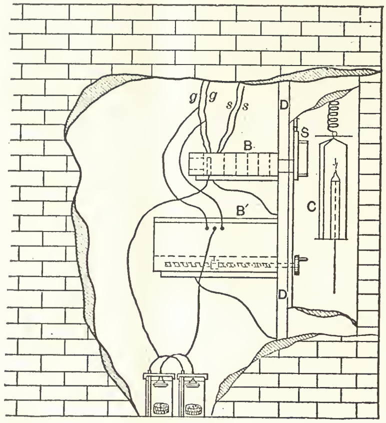


Fig. 2.

The bolometer, compensating resistance, and battery were all placed in an interior room, with thick brick walls, and having communication with the outer room only by a door, D, Fig. 2.

The temperature of this room changed very slowly, and it was quite free from drafts. The bolometer box, B, was placed upon a shelf fastened to the door of the room, and looked out through a hole in the door upon the outer room. A double screen, S, of tin, arranged to slide up and down on the outside of this door, covered up the bolometer strips when desired. The box B′, containing the compensating resistance, was also fastened to the inside of the door. The end of the box through which the screw projected, fitted into a hole in the door, so that the screw would be turned and the bridge balanced from the outer room.

(To be continued.)

Strength of Wire.—A piece of pianoforte wire recently tested at the Watertown Arsenal showed the extraordinary strength of 206 tons per square inch. The wire was one-twelfth of an inch in diameter; larger sizes give a tensile strength of 135 tons and upward per square inch. The metal contained 0.85% of combined carbon.—Industrial World.

Baltimore, Md.—The Bayview Electric Light and Power Co. and the Chesapeake Water Co. have consolidated as the Chesapeake Electric and Water Co. Capital stock, $100,000.

The Electrical Age.

Established 1883.

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TEMPERATURE OF THE ELECTRIC ARC.

To measure an all-consuming heat is a great scientific achievement. Of all great sources of heat perhaps the sun and the electric arc are best known. The sun is so hot, so far beyond our wildest guess, that its temperature is completely unknown. Prof. Paschen considers 5,130 deg. C. the nearest approach to the correct value. In Fahrenheit degrees this is equivalent to 9,266 degrees, a state of incandescence below our expectations.

Helmholz believes a contraction of the sun from its primitive nebulous volume to its present size would give rise to an increase of temperature of 28 millions of degrees, centigrade. Thus it is seen that we have to deal with suggestive estimates which imply conditions natural or constrained, and which in themselves but lead to further inquiry. The heat of the arc is as great a problem as that of the sun. Experiments made by Fizeau and Foucault enabled them to arrive at the conclusion that the intensity of light produced with respect to the sun was expressed by the ratio of 385 : 1000. The temperatures are thus compared in a crude manner. It would seem from these results that a powerful arc light produces a degree of heat which varies from one-quarter to one-sixth of that existing at the sun. Diamonds, graphite and particles of carbon are instantly volatilized, thus showing a heat of thousands of degrees, Fahrenheit.

STREET LIGHTING.

The first evidence of advancing civilization is good street lighting. Its bearing upon the growth of a town and influence in dispelling crime are too well known to need reference here. But aside from all these considerations, towns have been slow in many cases in adopting the most highly developed systems of lighting.

The reason for this has been due to the diversity of opinion existing in regard to the true cost of light. Towns with but a limited sum at their disposal are not apt to plunge into a new expense, however great the benefits, unless the commercial side has been thoroughly investigated. Many places favor the use of gas. In combination with an improved burner, they feel frequently more assured of the expense, and are not torn by conflicting emotions at the idea of a sudden and mysterious death. Such towns, however, are conservative because they lack courage. The established success of electric street lighting has no need of defending its position at present. Towns exist in abundance which feel no fear for the future of electric lighting. None that have failed in its satisfactory utilization can blame anyone but themselves. In a certain section of Orange County, a town has blossomed forth which adopted an old and useless system of electric lighting. Gas would be far more preferable. Yet the people look with pride upon its dim glory and feel a serene joy because their town, as they think, is alive, well lit and prosperous.

GAS RAILWAYS.

There are sources of power today that might be developed to an extraordinary extent. The use of compressed air has been persistently attempted. It is necessary for the public good that the great masses understand the distinction, that constantly requires definition, in the meaning of the word "success." The newspapers are aglow with professional excitement when the news of a new engineering enterprise reaches them. An inflated, unscientific and unsatisfactory account reaches many hungry ears. If an engine run by steam, gas, electricity or compressed air moves, a pæan of joy arises. Columns of enthusiastic predictions appear at once. Commercial success is not considered while the delusion prevails. Perhaps, then, exitement subsides, and the pretty experiment that has inspired so many hopes is seen in the cold, clear light of reason—a scientific success—a commercial failure. Gas for the propulsion of trains has occupied the attention of many competent engineers. It is estimated that the cost of a gas railway would be limited to $26,170 a mile. Roads have been built that did not exceed $28,000 per mile which give excellent satisfaction. While experiments are being made with compressed air it would be interesting to hear of those based upon a more definite experience and using gas. It requires only 32 cubic feet per mile for a ten-horse power car; in all about four cents a mile.

A new process for priming and decorating glass has been invented by Paul Gerard and Gustave L. T. des Paturelles. The surface of the glass is coated with ordinary collodium or a solution of nitro-cellulose in a dissolvent. When the dissolvent has evaporated there remains upon the glass a very adhesive cellulose layer, transparent and capable of receiving any kind of decoration by impression, painting, dyeing, gilding, etc. The collodium can be colored at the start by means of colors soluble in alcohol and in the dissolvent used for the cellulose. Hereby an inherent colored layer is produced on the glass, and if the latter is transparent the product resulting from this process can be substituted advantageously for glass colored in the batch. This process can be applied successfully to metals, marble, porcelain and other pottery.—American Manufacturer.

ALTERNATING CURRENTS.

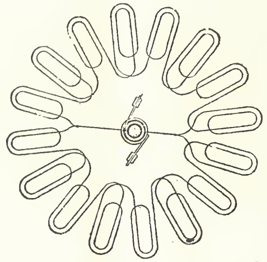
LESSON LEAVES
FOR
THE AMERICAN SCHOOL OF ELECTRICITY.

BY NEWTON HARRISON, E. E.

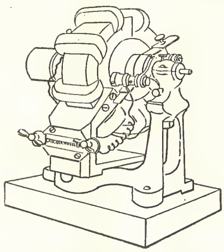
In the many applications of power to various industries none have so occupied the attention and interest of engineers as the use of alternating currents. Years ago the alternator was accepted as a simple device for the generation of reversing currents. Its comparative cheapness of construction and ease of operation have always placed it foremost as the basis of a power plant stretching over rough and rugged countries where attention and skill are of the lowest order. Jablochkoff invented his historic candles for alternating currents and thereby drew attention to its usefulness for arc lighting. In its varied applications we meet with many unique effects. It is striking to notice the results obtained by applying it for the production of light and power and the remarkable developments that have issued from the many attempts to produce a constant and steady light, a self-starting and independent source of power. These problems have gradually reduced the field of alternating-current work to certain constricted lines.

The labors of the past do not partake of the brilliant successes of the present. Continuous and alternating currents stand side by side as indispensable power factors, to be individually applied according to the circumstances, each with its own peculiar set of apparatus designed and perfected to perform its special work.

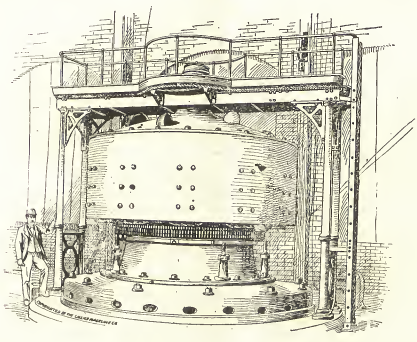
It is then necessary to accept the achievements of the past as but the beginning of a vast engineering revolution, the final outcome of which will be a new and infinitely more economical means of illumination and a cheaper source of power.



ARMATURE WINDING OF ALTERNATOR.



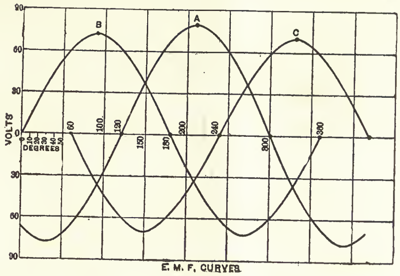
MODEL ALTERNATOR.



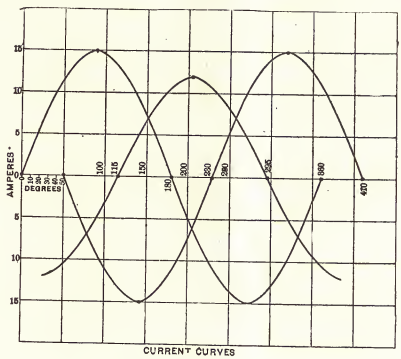
NIAGARA GENERATOR

An alternating current is one in which the flow of elec-

tricity is constantly reversing. It rises to a high value like an ocean wave and recedes, growing again in the opposite direction in a similar manner. The growth of the current and its reversal in this peculiar manner is due to the arrangement of the lines of force when cut by a revolving conductor. In the alternator a series of poles are arranged around a common centre pointing inwards. As a conductor passes in front of them, each pole creates within the wire a wave of electromotive force. When the wire passes in front of the north pole the rise and fall of current is the reverse of what it would be in front of a south pole. These poles are always some multiple of two—either four, six or eight poles, etc. Therefore we have as many north as south poles. The conductor develops while rotating a continued succession of rapidly reversing waves of electricity, which have earned the name of alternating currents.

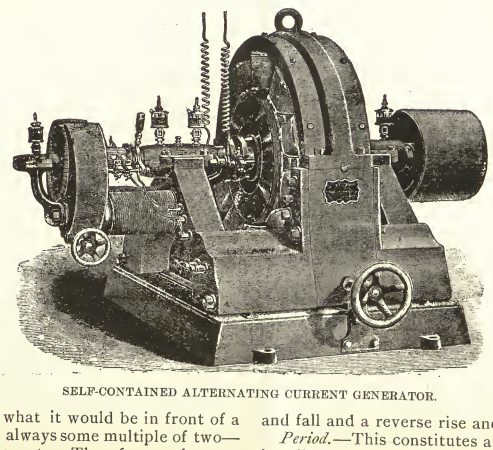


E. M. F. CURVES



CURRENT CURVES

Frequency.—The rapidity with which these waves reverse back and forth is called their frequency. If a wire passes in front of a south pole the current rises and falls, but *does not reverse* in direction. If continued past a north pole, the reversal does occur; it is therefore necessary for the wire to pass before two unlike poles to provide a rise and fall and a reverse rise and fall.



SELF-CONTAINED ALTERNATING CURRENT GENERATOR.

Period.—This constitutes a complete current wave. It is called a period. The number of periods are dependent

upon the

Number of pairs of poles.
Speed of the dynamo.

To calculate the number of periods in an alternator we observe the following rule:

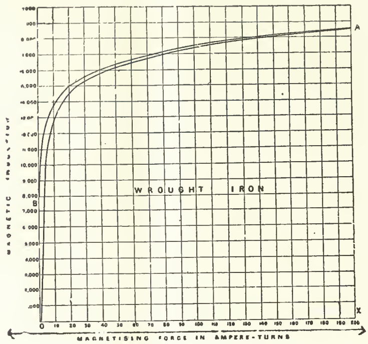


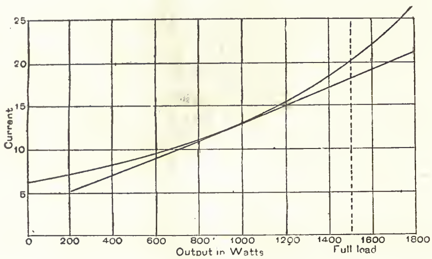
FIG. 1

CURVE OF MAGNETISATION.

Number of periods = one-half of the poles $\times$ revolutions per second.

Take a dynamo having poles = 8
speed = 1,200.

Periods = $4 \times 20 = 80$ per second.



POWER CURVE.

Phase.—The rush of electromotive force through a wire is such that the entire electrical influence does not pervade it until an instant afterwards. The current does not instantly flow; a certain inertia, as it were, prevents it. The retarding influence may be either the resistance or the self-induction of the circuit.

While it is true that an electric current requires both pressure and amperes to properly deserve the name, it is possible to imagine, upon the closing of a circuit, the electromotive force at work almost at once, as though it were merely a static effect and the current requiring an exceedingly short interval afterward to follow it. In other words, pressure or potential arrives at a given point and affects it before current. The interval elapsing is called the difference of phase. There are two ways of regarding it—as an interval of time or as an angle of difference.

To our minds' eye the first is preferable, as it supplies a physical something within the grasp of all.

Impedance.—The retarding effects of resistance and self-induction give rise to a condition called impedance. The circuit acts as if affected by a heavy resistance; the current is restrained from flowing, and without any great consumption of energy the flow is choked. The frequency also gives rise to this condition to a greater extent than self-induction.

ELECTRIC MOTORS IN SHOP WORK.

The employment of electric motors, so arranged that they may be readily moved from point to point in the shop, as occasion may demand their services, is spreading with considerable rapidity both in Europe and in America. By this method the power is conveyed without trouble to any desired locality, the necessary connections are quickly made, and the results are eminently satisfactory in every respect. In a recent American installation, the motor is used in this way, in an establishment engaged in the building of heavy special and standard tools. The main shop is about 500 feet long by 70 feet wide, and at each side, extending the entire length, is a bay about 25 feet wide. The entire length of the central portion of the building is traversed by electric cranes. The electric conductors feeding the crane motors are tapped at the columns, where the necessary connecting devices are put in. Four portable electric motors, ranging from two to eight horse power, are in use. The smallest is arranged for drilling and tapping, and is provided with all the attachments needed for securing it in working position on the piece to be drilled. This motor can be carried about the shop by hand. The large motors are mounted upon heavy bases, and are geared down so as to drive a pulley at the speed of the main driving shaft. They also have in the upper part of their frame, rings by means of which they may be lifted and moved by the travelling cranes as required. The motors are self-contained machines in every respect, and are furnished with all the electrical devices necessary for their control and operation. The convenience of this equipment and the ease and rapidity with which the motors can be moved and connected for working can be best illustrated by the statement that in one day one of the large motors can be, and has been, used on three different machines in as many different locations.

INTERIOR CONDUIT AND INSULATION CO.

The recent Electrical Exposition aroused New York and the neighboring precincts to the fact that electrical engineers were booming. People speak of art galleries and flower shows, of horse fairs and crystal mazes; they are pretty exciting, no doubt, but don't hold a candle to some choice corners of the past exhibition. The Interior Conduit and Insulation Company were alive every night of the show. They had a first-class exhibit showing their famous interior conduit, dental outfits and elegantly finished motors.

The illustration gives one an idea of what it looked like. Motors were there of all sizes, from the little fan to those of several thousands of pounds in weight, and dynamos to run all the way from 10 to 500 lights. The beautiful arrangement of the machines gave an excellent chance to the technical visitor to give them a thorough inspection. As models of compactness and skilful design they represent the trained effort and commercial success of a most substantial firm. The Interior Conduit and Insulation Co. know when they have a good thing and they push it along. Factory and offices, No. 529 West 34th street, New York.

NEW THEATRE DIMMER.

The Ironclad Rheostat Co., of Westfield, N. J., have placed a line of new goods on the market. Their rheostats are made entirely of cast-iron, inside of which, hermetically embedded and sealed in a solid insulating material, are the resistance wires.

These are so disposed that, while thoroughly insulated from, they are in the closest possible juxtaposition to the iron shell.

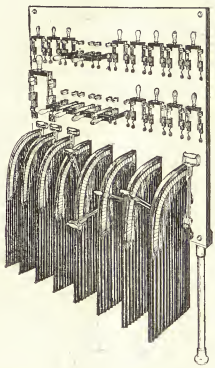
This shell acting as a radiator, safely and rapidly dissipates the heat caused by the electric current passing through the resistance wires.

They are particularly designed for the limited space in the wings of a theatre, taking up no more room than the switch alone of the old style dimmers.

The throw of the switch is so proportioned that (where several dimmers are installed) any or all of the dimmers may be thrown in simultaneously.

Large dimmers are made up of two or more plates bolted together and connected in series, the terminals of the steps being brought to the contacts on the face plate.

The steps are graduated so that the lamps will be dimmed gradually and the light reduced to one-sixth of the full candle-power.



GROUP OF THEATRE DIMMERS.

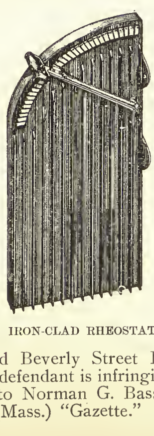
These dimmers are intended to supply the demand for dimmers, which have more steps than their standard 21-step dimmer, and they will be equipped with switch-handles which operate in 90° of the circle, giving maximum effect with the minimum movement of the switch. These dimmers are made by the same process as their several other standard styles of dimmers, and they confidently expect that they will fill a long felt want for a low priced dimmer with increased number of steps.

With this new type of dimmer they now have the most complete line of theatre dimmers in the market, and are prepared to furnish any sizes and any combinations.

Particnlar attention also may be called to the fact that they build special theatre dimmers singly or in banks with fifty-five steps equipped with interlocking switches.

ELECTRIC CAR MOTOR PATENT.

In the United States Circuit Court, Boston, yesterday, a bill was filed in equity, which is brought by the Thomson-Houston Electric Company against the Gloucester, Essex and Beverly Street Railroad Company, claiming that the defendant is infringing upon patent No. 457,102 granted to Norman G. Bassett for electric car motors.—Salem (Mass.) "Gazette."



IRON-CLAD RHEOSTAT.

Baltimore, Md.—The Central Railway Company will erect a new power house and remove its present plant to the same. A new power plant, machinery, etc., will be contracted for. Address G. Blakiston, president.

Asbury, Park, N. J.—The Atlantic Coast Electric Railway Co. and the West End and Long Branch Railway Co., which control the electric road between Pleasure Bay and Asbury Park, have been consolidated.

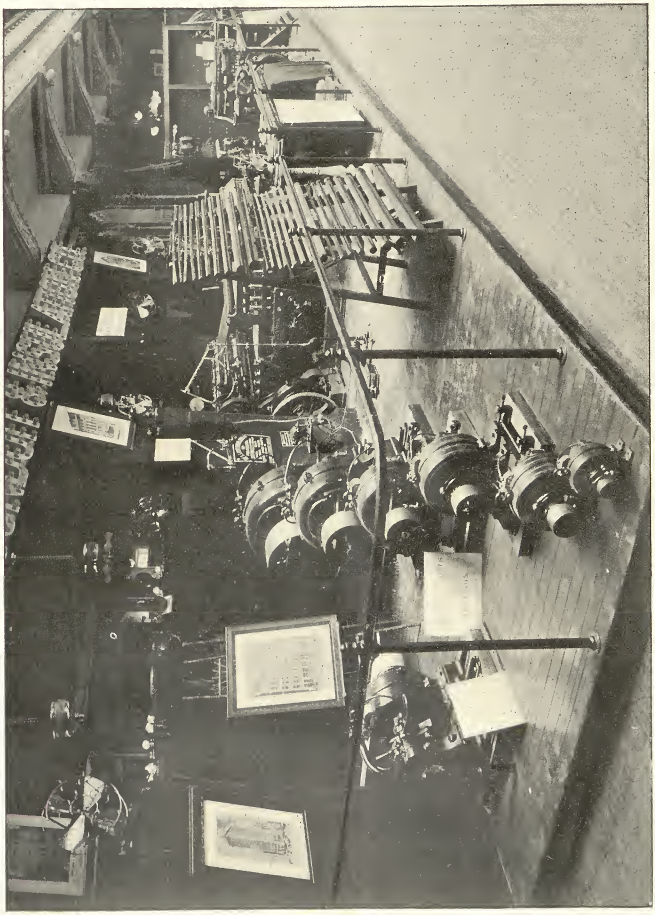
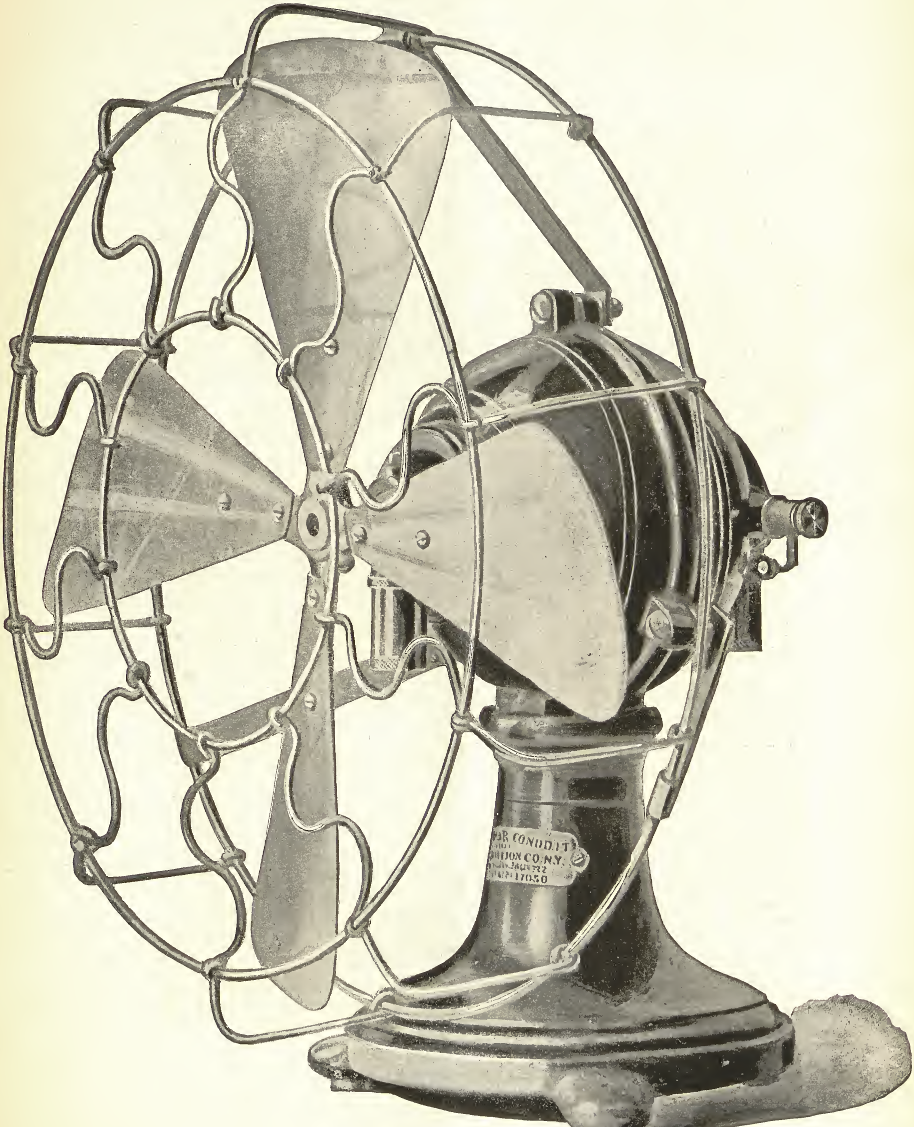


EXHIBIT SHOWING LUNDELL MOTORS, DENTAL OUTFITS AND SAMPLES OF INTERIOR CONDUIT.



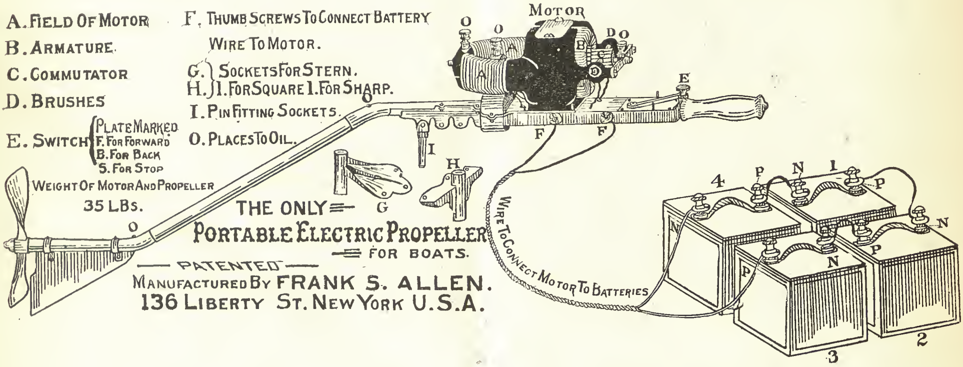
PORTABLE ELECTRIC PROPELLER.

One of the most ingenious devices ever made for the comfort of country and suburban residents is manufactured by Frank S. Allen, of 136 Liberty street, New York. Many an enterprising individual has tried to build an electric launch, and gloried in the thought of its silent power moving him swiftly through the water. Moonlight on the lake isn't in it with an electric propeller attachment. This ingenious little invention can be applied to any boat. A few cells of battery, which cause no trouble at all, a rudder and motor in one, and the deed is done. The little screw cuts through the water, driven by the potent electric current, without even a murmur. This is the thing for the promotion of happiness. Call on the inventor. You wont be able to resist ordering one and recommending it to all your friends. The address is above, 136 Liberty street.

leave nothing to be desired. The external parts are heavily nickeled and japanned, thus giving it a most attractive appearance. The field coils are series wound with green covered wire. The rheostat is made of german silver wire insulated by asbestos and mounted on a slate switchboard conveniently hidden within the base. The motor has three speeds, giving perfect satisfaction to the trade and to thousands of customers that at present use them.

WESTERN TELEPHONE CONSTRUCTION CO.

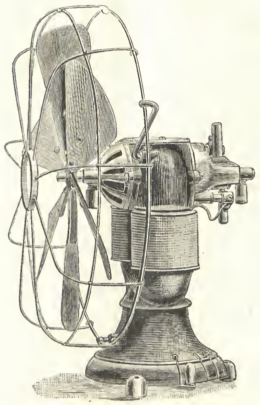
W. W. Bostwick, Jr., New York agent for the Western Telephone Construction Co., No. 38 Park Row, gives us the encouraging news that a large business is being done by his company. He has just closed a nice order from the Garvin Machine Co., of New York, for thirty-drop multiple circuit switchboard and complete telephone out-



THE ECK FAN MOTOR.

The Eck improved fan motor, manufactured by C. A. Eck, No. 116 Wooster street, N. Y., is an excellent sample of the latest and best design in electric fans. It has wrought-iron field cores and an ironclad armature.

fits. He has several other large plants under way. In the American Book Co., New York, they have installed a twenty-five drop plant. Several other large establishments are using their goods and feel highly satisfied with their investment. The apparatus is first-class, finely finished and in every sense a great convenience. At



ECK IMPROVED FAN MOTOR.

All the parts are guaranteed to be perfectly well insulated, thoroughly ventilated and protected in every respect.

The bearings are up to date, being self-oiling, and the self-feeding carbon brushes and finely finished commutator

Richmond, Va., an exchange of two thousand telephones has been installed. At Fort Wayne, Ind., between one thousand and fifteen hundred telephones have been set up in an exchange. At LaCrosse, Wis., they took out a

nine-hundred drop exchange and replaced it with the Western Telephone Exchange.

This company installed the one hundred and fifty-telepone equipment in the Interior Department at Washington, D. C. Several of the daily papers mentioning this plant were ignorant at the time of the manufacturers. With the great success they have had, a splendid future lies before them.

POSSIBLE CONTRACTS.

New York City.—Preliminary papers have been signed for the sale of the St. James Hotel property, at the southwest corner of Broadway and 26th street. The buyers are Philadelphians, who propose to erect a sixteen-story office building to cost $1,500,000. Architect Bruce Price has been commissioned to draw the plans.

Lakewood, O.—The special election held in Lakewood, to determine whether the hamlet should be bonded for $20,000, to purchase an electric light plant, was carried. The plant will be erected as soon as possible. It will provide 80 arc lamps and 1,000 incandescent lamps, the entire plant to cost $20,600. Wm. F. Classe, clerk.

New York City.—Ground is soon to be broken for the new building for the New York Medical College and Hospital for Women, at 79th street and 8th avenue.

New York City.—The Gas Engine and Power Company will erect a two-story iron and steel boiler house and machine shop at Morris Dock, Morris Heights, at a cost of $30,000.

Ocala, Fla.—The time for receiving bids for the electric light plant at Ocala has been extended to August 20.

Barnesville, Ga.—$7,000 in bonds will be issued to put in an electric light plant at Barnesville.

Chicago, Ill.—Marshall Field, who gave $1,000,000 to found the Field Museum, announces that he will give $2,000,000 more to provide a suitable home for the museum on the lake front.

John Jacob Astor, 23 West 26th street, has in contemplation the construction of an apartment hotel at the southeast corner of Fifth avenue and 55th street.

The Central Syndicate Building Co. will erect a fine fifteen-story building on the northeast corner of Broadway and Pearl street. J. T. Williams has been appointed the supervising architect.

Trenton, N. J.—The new wing and hospital at the state prison will be entirely completed in about ten days. The commission is about to take up the consideration of a new lighting plant.

Vallejo, Cal.—Bids will be opened August 19 for the construction of an electric plant at Vallejo.

Albany, N. Y.—The Albany Railway Co. will extend its lines to Cohoes, and has already made application to the authorities of Colonie for permission to extend the tracks of the company through the town. The approximate cost of the new line will be about $125,000.

Norfolk, Va.—The First Presbyterian Church will be fitted out with electric lights, and an electric motor will also be installed for the organ.

Pottsville, Pa.—A complete electric lighting plant will be installed in the new building now being erected by Dives, Pomeroy & Stewart.

NEW CORPORATIONS.

Zanesville, O.—The Zanesville Street Railway and Electric Company was incorporated with a capital of $500,000.

Cleveland, O.—The Northeastern Railway Co., incorporated. Incorporators, Frank S. Lickens, Charles N. Sheldon, William D. Bennett and others. Capital, $100,000. They will build an electric line from the north of Euclid Ave. throngh Lake, Cuyahoga and Summit Counties to Hudson.

New York City.—The American Engineering Works, to manufacture and deal in machinery and gas and electric apparatus. Capital, $5,000. Directors, Frank M. Ashley of Brooklyn, and John J. Hankenhof of New York City.

Syracuse, N. Y.—The Onondaga Lake Railroad Company was incorporated to construct a double track street railroad about seven miles in length from Clinton Square, in Syracuse, to the resort known as Long Branch. Capital, $250,000. Incorporators, John S. Kaufman, W. R. Smith and others.

Bath, Me.—The Car Trolley Head Company, for the purpose of purchasing and controlling appliances for building, improving and operating electric railways and rolling stock. Capital, $100,000. President, Warren H. Carr of Bath; Treasurer, Charles R. Donnell, of Bath.

TELEPHONE NOTES.

Baltimore, Md.—In accordance with the ordinance granted by the City Council the Home Telephone Co. is now preparing to contract for the construction of its system. Address W. J. Atkinson, Manager.

Kansas City, Mo.—A franchise for a telephone system has been applied for by D. A. Williams and associates. It is said that they represent the Standard Telephone Co., of Wisconsin.

Evansville, Ind.—The Cumberland Telephone Company is making arrangements to extend its wires from this city to all of the surrounding towns of any importance.

NEW TELEPHONE COMPANIES.

Bellefonte, Pa.—The North and West Branch Telephone Co. It will operate a system of lines to be constructed in the counties of Clinton, Lycoming, Northumberland, Montour, Columbia, Luzerne and Lackawanna. Capital, $50,000. Directors, Monroe H. Kulp, W. W. Ryon, J. O. Shipman of Shamokin, and others.

Waynesburg, Pa.—A charter has been granted the Waynesburg Bluff and Cameron Telephone Company. Capital, $2,000. The company will build a telephone line from Waynesburg, via. Bluff, Higbe and Sugar Grove to Cameron, W. Va.

Albany, N. Y.—The state is to construct a telephone line between Albany and Buffalo, along the Erie canal, so that the division and section superintendents, lock tenders, patrolmen and watchmen can readily communicate with one another and Superintendent Aldrige's office in Albany.

TELEPHONE PATENTS.

ISSUED JULY 7, 1896.

563,240. Multiple Switchboard System for Telephone Exchanges. Oro A. Bell, Brooklyn, N. Y. Filed May 19, 1892.

563,318. Bridging Bells. Charles E. Scribner, Chicago, Ill. Filed March 6, 1891.

563,320. Multiple Switchboard for Telephone Exchanges. Charles E. Scribner, Chicago, Ill. Filed March 5, 1892.

563,321. Incandescent Lamp. Charles E. Scribner, Chicago, Ill. Filed May 9, 1893.

563,322. Telephone Circuit. Charles E. Scribner, Chicago, Ill. Filed June 16, 1893.

563,323. Testing Apparatus for Multiple Switchboards. Charles E. Scribner, Chicago, Ill. Filed November 13, 1893.

563,327. Telephone Exchange Switchboard. Charles E. Scribner and Ernest P. Warner, Chicago, Ill. Filed February 7, 1890.

563,352. Individual Calling Apparatus. William W. Alexander, Kansas City, Mo. Filed April 8, 1893.

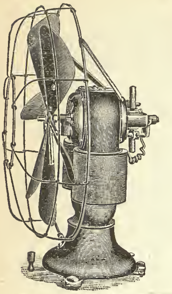
563,393. Telephone Transmitter. William A. Moore, Brooklyn, N. Y. Filed March 25, 1896.

563,614. Telephone System. Jean Piel, New York, N. Y. Filed April 13, 1896.
563,692. Telephone Signaling Circuit. John S. Stone, Boston, Mass. Filed March 18, 1896.

ELECTRICAL and STREET RAILWAY PATENTS.

Issued July 7, 1896.

563,254. Electric Railway. Henry Brandenburg, Chicago, Ill. Filed April 16, 1895.
563,257. Lightning Arrester and Automatic Fuse Block. Thomas L. Carleton, New Orleans, La. Filed February 28, 1894.
563,269. Combined Annunciator and Fire Alarm. Manious Garl. Akron, Ohio. Filed September 27, 1894.
563,273. Means for Insulating Electric Conductors. Theodore Guilleaume, Mulheim-on-the-Rhine, Germany. Filed March 19, 1895.
563,274. Electric Cable. Theodore Guilleaume, Mulheim-on-the-Rhine, Germany. Filed November 2, 1895.
563,282. Electric Railway. Eduard Lachmann, Hamburg, Germany. Filed June 30, 1894.
563,288. Electrical Production of Chemical Reactions. Walter Lobach, Chicago, Ill. Filed November 30, 1894.
563,290. Method of Automatic Current Regulation of Dynamo-electric Machines. Frederick H. Loveridge, Coldwater, Mich. Filed August 6, 1894.
563,294. Apparatus for Selective Signal Systems. Frank R. McBerty, Downer's Grove, Ill. Filed August 23, 1895.
563,304. Electrically Controlled Boat-Steering Apparatus. Charles E. Ongley, New York, N. Y. Filed December 20, 1892.
563,315. Electric Arc Lamp. Charles E. Scribner, Chicago, Ill. Filed January 2, 1883.
563,316. Speed-regulator for Dynamos. Charles E. Scribner, Chicago, Ill. Filed December 10, 1888.
563,317. Speed-regulator for Dynamos. Charles E. Scribner, Chicago, Ill. Filed December 10, 1888.
563,319. Incandescent Lamp. Charles E. Scribner, Chicago, Ill. Filed July 20, 1891.
563,324. Electric Police-signal System. Charles E. Scribner, Chicago, Ill. Filed May 14, 1894.
563,326. Contact Point for Electrical Instruments. Charles E. Scribner, Chicago, Ill. Filed August 17, 1895.
563,329. Process of Building up Carbon Filaments. Frank S. Smith, Pittsburgh, Pa. Filed August 29, 1892.
563,335. Circuit-re-establishing Cut-out. Albert L. Tucker and Frederick H. Loveridge, Chicago, Ill. Filed August 8, 1895.
563,336. Electric Signaling Apparatus. Frederick W. Turner, Newton and Winthrop M. Chapman, Needham, Mass. Filed April 18, 1891.
563,342. Cable Terminal Attachment. Arthur T. Welles, Chicago, Ill. Filed March 3, 1896.
563,379. Flexible Mica Insulating Sheet. Charles W. Jefferson, Schenectady, N. Y. Filed March 16, 1895.
563,407. Electric Switch. Charles G. Perkins, Hartford, Conn. Filed April 1, 1896.
563,425. Power Gearing for Electric Cars. Elmer A. Sperry, Cleveland, Ohio. Filed June 9, 1894.
563,426. System of Electrical Distribution. Charles P. Steinmetz, Schenectady, N. Y. Filed January 30, 1895.
563,427. Compound-wound Multiphase Generator. Chas. P. Steinmetz, Schenectady, N. Y. Filed March 19, 1896.
563,428. Storage Battery. William J. Still, Toronto, Canada. Filed September 18, 1894.
563,440. Electric Motor. Ernst J. Berg, Schenectady, N. Y. Filed October 8, 1895.
563,442. Electrical Signaling Apparatus. Samuel S. Bogart, Schraaleuburg, N. J. Filed October 16, 1894.
563,443. Electrical Selector. Samuel S. Bogart, Schraalenburg, N. J. Filed January 5, 1895.
563,453. Magneto-electric Machine. Peter J. Crouse and Ellsworth W. Milgate, Utica, N. Y. Filed September 7, 1895.
563,474. Automatic Fire Alarm. Joseph W. Frost, New York, N. Y. Filed February 18, 1888.
563,475. Thermostat and Circuit Therefor. Joseph W. Frost, New York, N. Y. Filed March 28, 1890.
563,482. Insulating Support for Rails of Electric Railways. Patrick Haley, Chicago, Ill. Filed March 9, 1896.
563,491. Electric Tunneling Machine. Herbert R. Keithley, Chicago, Ill. Filed May 21, 1892.
563,527. Process of Producing Calcium Compounds. Thomas L. Wilson, New York, N. Y. Filed March 16, 1893.
563,531. Trolley-catcher. Charles F. Wilson, Brooklyn, N. Y. Filed March 6, 1896.
563,575. Reversing Controller for Electric Motors. Alva C. Dinkey, Munhall, Pa. Filed September 3, 1895.
563,586. Automatic Repeater. Joseph W. Frost, New York, N. Y. Filed August 16, 1892.
563,599. Magneto-electric Generator. Arthur G. Leonard, New York, N. Y. Filed August 10, 1894.
563,600. Rheostat for Electric Motors. Harry W. Leonard, New York, N. Y. Filed June 21, 1895.
563,716. Electrical Insulating Sheet. Charles W. Jefferson, Schenectady, N. Y. Filed November 23, 1895.



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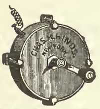

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Four-spindle Hendey Gang Drill, with chucks,
Four-spindle Garvin Gang Drill, with chucks.
Two-spindle Slate Sensitive Drill.
Four-spindle Woodward & Rogers Sensitive Drtll.
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24in x2[illegible]in.x6ft. Putnam Machine Co-'s Planer.
27in.x2[illegible]in.x[illegible]ft. Gay & Silver Planer.
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